REMARKS

This paper is being submitted in response to the Office Action mailed December 13, 2002, for the above-referenced application. In this response, Applicant has cancelled claims 2, 3, 5, 7, 9, 15, 16, 19 and 20.

The Examiner requests new application papers with lines double spaced on good quality paper. Applicant has attached hereto a complete copy of the specification as originally filed having double spaced lines.

Applicant notes that in the copy returned to Applicant of the PTO Form 1449 submitted as a Supplemental Information Disclosure Statement (IDS) along with the previous Office Action response, the entry for the reference entitled "Build the Super-Versatile Quadrafuzz" by Craig Anderton does not bear the initials of the Examiner as having been reviewed and considered. Applicant has resubmitted this reference in a Supplemental IDS accompanying the present response and respectfully requests that the Examiner initial the Anderton reference as well as the other included references where indicated on the submitted PTO Form 1449.

The present invention relates to the application of allpass cross-over filters to assist in applying multi-band distortion in a musical instrument preamplifier system, such as a guitar preamplifier. In general terms, the invention involves splitting an input signal into a number of frequency bands, each with an equi-phase response, and two or more non-linear circuits, each for distorting one of the frequency bands. The deliberate introduction of distortion provides a sound that is desirable to the musician using the system.

The arrangement improves on existing systems that attempt to introduce distortion. Splitting the input signal into frequency bands enables the deliberate harmonic distortion to be introduced in a controlled manner. Splitting the input signals into bands also reduces intermodulation products, which can introduce undesirable distortion that does not produce the required effect. The equi-phase response assists recombination of the frequency bands, after distortion has been applied.

The rejection of claims 2, 3 and 5 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,412,100 to Orban (hereinafter "Orban") has been rendered moot by the canceling of claims 2, 3 and 5 herein.

The rejection of claims 7, 9 and 13 under 35 U.S.C. 103(a) as being unpatentable over Orban in view of Japanese Patent No. JP 404142598A to Koichiro (hereinafter "Koichiro") is hereby traversed and reconsideration is respectfully requested. Claims 7 and 9 have been cancelled herein.

Independent claim 13 recites a guitar preamplifier. A filtering means splits an input signal into a multiple number of separate frequency bands, comprising a cascade of 2^N - 1 pairs of even poled low and high pass filters. The filters are arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade. Each low and high pass filter forms a state variable filter and in each nth stage subsequent to the first, each low or high pass filter pair is preceded by $(2^{n-1} - 1)$ all pass filters having phase responses of the $(2^{n-1} - 1)$ low or high pass filter pairs in other channels such that he phase response of each stage is similar for each frequency band. The filtering means further comprises variable cross-mixing after one or more of said stages of filting. A multiple number of linear circuits are each arranged to distort the input signal component of one of the frequency bands. A summing network recombines the frequency bands including low pass filtering means arranged such that in successive stages the lowest frequency bands is low pass filtered with a low pass filter and the other frequency bands are all pass filtered with an all pass filter corresponding to the low pass filter. The lowest frequency band is then combined with the next lowest frequency band and subsequent stages of repeated filtering and combining until all frequency bands are combined such that the phase response over all frequency bands through the low pass filtering and summing network is identical.

The Orban reference discloses a multiband analog audio process which provides low peak-to-r.m.s ratios of audio signals. A distributed crossover system is used with bandpass filters containing internal clippers.

The Koichiro reference discloses an electronic musical instrument having a musical signal generating circuit to generate digital musical sound signals. The Office Action cites Koichiro as disclosing filtering means further comprising variable cross-mixing after one or more of said stages of filtering.

Applicant's independent claim 13 recites at least the feature of a cascade of 2^N - 1 pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade. Further, each low or high pass filter is preceded by $(2^{n-1}$ - 1) all pass filters having phase responses corresponding to the other low and high pass filter phase responses in that stage. Applicant respectfully submits that neither Orban nor Koichiro, taken alone or in any combination, teach or fairly suggest at least the above features as claimed by Applicant.

Specifically, Orban does not disclose a cascade of 2^N - 1 pairs of filters. If, for example, as shown in Orban's Figure 3, filters 16 and 45 were considered as the first stage in the cascade and filters 11, 35 and 47 were considered as a second stage in the cascade, then this does not equate to 2^2 - 1 pairs (or 3 pairs) of filters after the second stage, in that there is not a pair of filters connected to the output of filter 45. The output of filter 45 is not split in two by a pair of filters. Further, each low and high pass filter pair is not preceded by an all-pass filter with a phase response corresponding to the other low and high pass filter phase response in that stage.

Applicant respectfully submits that Koichiro fails to overcome the above-noted deficiencies of Orban with respect to Applicant's claim 13. Specifically, neither Orban nor Koichiro teach or suggest at least the features of a cascade of 2^N - 1 pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, or that each low or high pass filter is preceded by $(2^{n-1}$ - 1) all pass filters having phase responses corresponding to the other low and high pass filter phase responses in that stage.

Accordingly, based on the above, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

The rejection of claims 15-16 under 35 U.S.C. 103(a) as being unpatentable over Orban in view of U.S. Patent No. 5,841,875 to Kuroki has been rendered moot by the canceling of claims 15 and 16 herein.

The rejection of claims 19-21, 24-25, 28, 30-33, 35-36, 38 and 40 under 35 U.S.C. 103(a) as being unpatentable over Kuroki in view of U.S. Patent No. 5,892,833 to Maag et al. (hereinafter "Maag") is hereby traversed and reconsideration is respectfully requested. Claims 19 and 20 have been cancelled herein.

Independent claim 21 recites a musical instrument preamplifier system. A filtering means splits an input signal into two or more separate frequency bands comprising a substantially equi-phase response for each frequency band. Two or more non-linear circuits are included, each of which distorts one of the frequency bands. A summing network recombines the frequency bands. Claims 22-32 depend directly or indirectly on independent claim 21.

Independent claim 33 recites a digital musical instrument preamplifier. A digital filtering means splits an input sampled signal into two or more separate output frequency bands comprising a substantially equi-phase response for each frequency band. Two or more non-linear digital circuits are included, each of which distorts one of the output frequency bands. A digital summing network recombines the frequency bands. Claims 34-39 depend directly or indirectly on independent claim 33.

Independent claim 40 recites a musical instrument preamplifier. A filtering means is included with a first filter network. The network includes an input, a plurality of outputs, and a plurality of band splitter filters to split a signal on the input into a plurality of substantially equi-phase frequency bands for the outputs. A plurality of non-linear circuits are coupled to a plurality of the outputs to distort respective output frequency bands.

The Kuroki reference discloses a digital audio signal process having a harmonics modifier for processing an input audio signal to produce an output audio signal. The harmonics

modifier is comprised of translating means for sequentially translating the input audio signal into an address signal according to a sampled amplitude of the input audio signal.

The Maag reference discloses a multi-band digital gain and equalizer system for receiving and processing an audio signal that includes an analog-to-digital converter, a plurality of digital filters, and a summing circuit. The Office Action cites Maag as teaching a digital filtering means (see Fig. 6c, 208) for splitting an input sampled signal into two or more separate frequency bands comprising a similar phase response for each frequency band (211a-211b and 212 a-212n) and as teaching a low pass filtering means combined with a summing network.

Applicant's independent claims 21, 33 and 40 recite at least the features of a filtering means for splitting an input signal into two or more separate frequency bands comprising a substantially equi-phase frequency bands and two or more non-linear circuits, each of which distorts one of the frequency bands. Applicant respectfully submits that neither Kuroki nor Maag, taken alone or in any combination, teach or suggest at least these features as claimed by Applicant.

As noted on page 9 of the Office Action, Kuroki fails to teach a digital filtering means for splitting an input sampled signal into two or more separate frequency bands comprising a similar phase response for each frequency band. Further, Kuroki does not teach or suggest a plurality of non-linear circuits coupled to distort respective output frequency bands. In Kuroki, the harmonic modifiers do not operate on *separate frequency bands signals*, but rather on a "copy" of the same entire signal.

Applicant respectfully submits that Maag fails to overcome the above noted deficiencies of Kuroki with respect to Applicant's claims. Specifically, Applicant respectfully submits that Maag does not disclose the splitting of an input signal into two or more separate equi-phase frequency bands. The frequency bands produced by the circuit disclosed in Maag *are not equi-phase for each frequency band.* The *overall phase response* of the separate bands when recombined may have an *approximate constant phase*; however, this is quite different from having equal phases in each frequency band. The distortion generation in the present invention

requires equal phases per frequency band, which Maag's circuit cannot provide.

Accordingly, in view of the above, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

Further, Applicant's respectfully submit that Kuroki and Maag relate to different fields and that therefore there is no motivation to combine them to arrive at the present invention. It would not be obvious to someone skilled in the art, who is instending to design a preamplifier, to combine the technology from these two fields.

The purpose of Kuroki is arguably to simulate a valve amplifier. The means of connecting harmonic modifiers in one of the Kuroki circuits simulates the preamplifier and power amplifier circuitry of the valve amplifiers. Valve amplifiers inherently produce distortion, which musicians consider a desirable side effect in circuit circumstances. Therefore, by deliberately simulating a valve amplifier, which has inherent distortion, a desirable level of distortion is achieved. To someone skilled in the art, the disclosure of Kuroki has a fundamentally different aim that that of the present invention.

Maag relates to the general technical field of sound systems, and improving the quality of these by removing noise and distortion. It has the opposite purpose of the present invention, which is to deliberately introduce harmonic distortion in a controlled manner. It would not be obvious to someone skill in the art to take Maag, which is directed to solving a different problem and apply it to design the present invention as defined in claims 21, 33 and 40. The frequency bands in the present invention are deliberately generated to assist in the objectives of applying controlled distortion and reducing intermodulation. It cannot be said to be obvious to take the frequency bands disclosed in Maag and apply distortion to them. The present invention is not arrived at by simply applying distortion to the frequency bands of Maag. Applicant respectfully submit that the frequency bands of Maag have been generated to achieve a different purpose not related to reducing intermodulation or applying controlled harmonic distortion.

The rejection of claim 41 under 35 U.S.C. 103(a) as being unpatentable over Kuroki in

view of Orban is hereby traversed and reconsideration is respectfully requested.

Independent claim 41 recites a musical instrument preamplifier system. A filtering means splits an input signal into a plurality of substantially equi-phase frequency band outputs. A plurality of non-linear circuits are coupled to filter means to distort respective output frequency bands, wherein the filtering means includes a cascade of a first filter network and one or more subsequent filter networks. Each network includes an input, a plurality of outputs, and a plurality of band splitter filters to split a signal on the input into a plurality of frequency bands for the outputs. For one or more of the subsequent networks, the input of each is coupled to one output of another network via a filter to provide substantially equi-phase frequency bands on the network's outputs. Outputs of some of the networks form frequency bands outputs of the filtering means.

The teachings of the Orban and Kuroki references are discussed above.

Applicant's independent claim 41 recites at least the features of a filtering means for splitting an input signal into two or more separate frequency bands comprising a substantially equi-phase frequency bands and two or more non-linear circuits, each of which distorts one of the frequency bands. Applicant respectfully submits that neither Kuroki nor Orban, taken alone or in any combination, teach or suggest at least these features. As discussed, in Kuroki, the harmonic modifiers do not operate on separate frequency band signals, but rather a "copy" of the same signal. In Orban, the subsequent networks are not connected to previous networks via a filter, rather the inputs are directly coupled to the outputs of the previous network. Accordingly, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

Further, Applicant respectfully submits that there is no motivation to combine the teachings of Kuroki with the teachings of Orban. Orban is directed to a different area of technology, namely signal processing of audio signals prior to radio transmission or recording to produce a signal which has a fairly constant average level. Therefore, it cannot be expected to be applied by someone skilled in the technology of musical preamplifier design.

Moreover, the purpose of Orban is actually to reduce distortion caused by attempting to equalize sound prior to transmission or recording. This is the opposite purpose of the present invention, which intends to deliberately introduce distortion in a controlled manner. Therefore, it could not be considered obvious to someone skilled in the art to take this technology and apply it to the field of creating multi-band distortion in a musical instrument preamplifier. The benefits of using separate frequency bands to improve prior art preamplifiers, by enabling the application of controlled distortion, and reducing intermodulation, is not suggested by Orban, as it actually *teaches away* from introducing distortion. Applicants respectfully submit that it is an inventive step to realize that using equi-phase bands in a guitar preamplifier assists in applying distortion.

The rejection of claims 22, 23, 29, 34 and 39 under 35 U.S.C. 103(a) as being unpatentable over Kuroki in view of Maag and further in view of Orban is hereby traversed and reconsideration is respectfully requested.

The features of Applicant's independent claims are discussed above. Claims 22, 23, 29, 34 and 39 depend therefrom. For the reasons discussed above with respect to the independent claims on which these claims depend, Applicant respectfully submits that neither Kuroki, Maag nor Orban, taken alone or in any combination, teach or suggest the present invention as claimed by Applicant. Accordingly, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

Furthermore, with respect to claims 22, 23 and 34, Applicant respectfully submits that, in addition to the arguments concerning the independent claims on which these claims depend, neither Kuroki, Maag nor Orban, teach or fairly suggest at least the features of a cascade of 2^N - 1 pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, or that each low or high pass filter is preceded by $(2^{n-1} - 1)$ all pass filters having phase responses corresponding to the other low and high pass filter phase responses in that stage, as claimed by Applicant.

The rejection of claims 26, 27 and 37 under 35 U.S.C. 103(a) as being unpatentable over Kuroki in view of Maag and further in view of Koichiro is hereby traversed and reconsideration

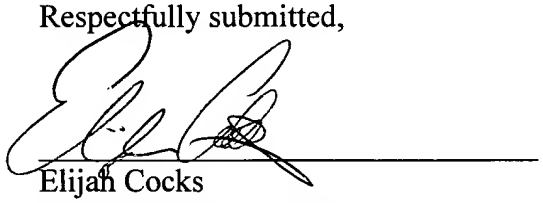
is respectfully requested.

The features of Applicant's independent claims are discussed above. Claims 26, 27 and 37 depend therefrom. For the reasons stated above with respect to the independent claims on which these claims depend, Applicant respectfully submits that neither Kuroki, Maag nor Koichiro, taken alone or in any combination, teach or suggest the present invention as claimed by Applicant. Accordingly, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding objections and rejections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4792.

Please charge any fees that may be required and which have not been provided for in accompanying documents or credit any overpayments to our Deposit Account No. 03-1721.

Respectfully submitted,



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